

IN THE UNITED STATES
PATENT AND TRADEMARK OFFICE

A

03/19/99
jci35 U.S. PTO

PATENT APPLICATION

INVENTOR(S) Albert D. Baker
James Cheng-Ping Liu

CASE 18-8

"Express Mail" Label No. ET 361 678 156 US
I hereby certify that this paper or fee is being deposited with the
United States Postal Service "Express Mail Post Office to
Addressee" service under 37 CFR 1.10 on the date indicated
below and is addressed to: Commissioner of Patents and
Trademarks, Washington, D.C. 20231.

Date of Deposit: March 19, 1999

Signature: Leresa M. Hamer

jci35 U.S. PTO
09/27/99
03/19/99

TITLE Symbol-Based Control of Terminal Endpoints in a Communication System

ASSISTANT COMMISSIONER FOR PATENTS
WASHINGTON, D.C. 20231

SIR:

Enclosed are the following papers relating to the above-named application for patent:

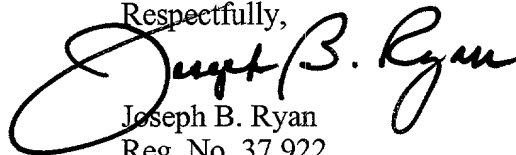
Specification
4 Sheets of informal drawing(s)
1 Assignment with Cover Sheet
Declaration and Power of Attorney
Information Disclosure Statement with PTO-1449 and cited reference(s)

CLAIMS AS FILED				
	NO. FILED	NO. EXTRA	RATE	CALCULATIONS
Total Claims	26-20 =	6	x \$18 =	\$108
Independent Claims	4-3 =	1	x \$78 =	\$78
Multiple Dependent Claim(s), if applicable			\$260 =	\$0
Basic Fee				\$760
TOTAL FEE:				\$946

Please file the application and charge **Lucent Technologies Deposit Account No. 12-2325** the amount of \$946, to cover the filing fee. Duplicate copies of this letter are enclosed. In the event of non-payment or improper payment of a required fee, the Commissioner is authorized to charge or to credit **Deposit Account No. 12-2325** as required to correct the error.

Please address all correspondence to: **Joseph B. Ryan, Ryan & Mason, L.L.P., 90 Forest Avenue, Locust Valley, New York 11560.** Telephone calls should be made to the under-signed attorney at (516) 759-7517.

Respectfully,



Joseph B. Ryan
Reg. No. 37,922
Attorney for Applicant(s)

Date: March 19, 1999
Ryan & Mason, L.L.P.
90 Forest Avenue
Locust Valley, New York 11560

**SYMBOL-BASED CONTROL OF TERMINAL ENDPOINTS
IN A COMMUNICATION SYSTEM**

5 **Field of the Invention**

The invention relates generally to communication systems, and more particularly to communication systems which support wireless mobile telephones or other types of wireless user terminals.

10 **Background of the Invention**

Communication system switches frequently deploy multifunction voice or voice-and-data terminals which generally require a complex multi-octet terminal protocol to drive the terminal interface and to control transport services. Such a multi-octet protocol is typically field oriented, and may include, e.g., a header field, a command pointer field, a command data field interpreted according to the contents of the command pointer, and an integrity check field. Each field is usually defined as a collection of one or more bits, and certain bits or collections of bits are dedicated to certain functions. This creates fixed relationships between bits and command interpretations. In addition, the deskset terminal design is such that a large number of bits are assigned or reserved for numerous feature keys and feature indicator controls. When such a system is upgraded to support wireless terminals, use of the existing wired terminal protocol is desirable from a switch software point of view, since re-use of the protocol is generally a low-cost implementation. Unfortunately, this conventional approach requires excessive bandwidth, and fails to optimize the control protocol for the wireless voice terminal.

There are a number of issues associated with use of an existing wired terminal protocol to support wireless terminals. For example, the wireless terminal by its very nature is designed to be small and easily portable. The direct consequence of this is that there is an extremely limited area on the terminal user interface for feature access presentation. This implies that the wireless terminal control protocol requires many fewer codepoints for feature button and associated feature indicator pairs. Further, the area for a switch-controlled display on the wireless unit may be much smaller, and therefore only a subset of the normative wired terminal display control functionality is required to support the wireless terminal. In addition, a significant portion of the information displayed by

a wireless terminal relates to the condition of the terminal itself, e.g., battery charge remaining, signal strength, etc., and is not commanded by the switch. Conventional techniques for utilizing a wired terminal protocol to support wireless terminals have failed to adequately address these and other important issues, and as a result these techniques suffer from the above-noted problems of excessive bandwidth consumption and lack of optimization.

A need therefore exists for techniques which allow an existing wired terminal protocol to be custom-fit to a wireless terminal interface, in order to capitalize on the existing switch software codebase, to reduce the amount of bandwidth consumed for terminal control, and to preserve the functionality of the system as represented to the user via the wireless terminal.

Summary of the Invention

The invention allows a switch or other communication system device to direct a system terminal to perform a set of command-based operations using a compressed symbol-based command format. The format in an illustrative embodiment is the result of cross-coding a collection of individual commands from an existing wired terminal protocol into a bandwidth-efficient set of command symbols, such that a particular combination of multiple wireless terminal commands are executed upon the transmission of a given symbol from a commanding switch. In other words, a given transmitted symbol is interpreted by the wireless terminal as corresponding to the particular combination of commands in the wired terminal protocol. The invention is not restricted to use in applications in which a wired terminal protocol is supported by a wireless terminal, as in the illustrative embodiment, but is instead more broadly applicable to any application in which an existing terminal protocol is used to support a terminal having a valid command space which is less than the full available command space of the terminal protocol.

In the illustrative embodiment, the set of command symbols may be generated by: (i) resizing a command space associated with the wired terminal protocol to obtain a reduced command space suitable for use with the wireless terminal; (ii) generating a tabular representation in which specific bit values from a first portion of the reduced command space correspond to columns and specific bit values from a second portion of the reduced command space correspond to rows; and (iii) assigning command symbols to valid entries in the tabular representation, such that a given one of the

command symbols uniquely identifies a particular combination of commands in the reduced command space. In operation, the switch transmits a given command symbol to the wireless terminal, and the wireless terminal decodes the symbol and executes the corresponding commands specified by the symbol. Similar techniques may be used for terminal-to-switch communications in accordance with the invention.

The above-described illustrative embodiment of the invention significantly reduces the command field associated with supporting the operation of a wireless terminal using an existing wired terminal protocol. This results in a proportional bandwidth consumption reduction when communicating over wireless communication channels, thereby preserving this scarce resource. The full functionality of the system, as expressed by the wired terminal protocol, is made available to the wireless terminal to the extent implementable in that terminal. In addition, there is no need to subject the command symbols to bitwise encryption, since their field mapping conventions in accordance with the wired terminal protocol are eliminated during the symbol generation process of the invention. These and other features and advantages of the present invention will become more apparent from the accompanying drawings and the following detailed description.

Brief Description of the Drawings

FIG. 1 shows a portion of an exemplary communication system in which the invention may be implemented.

FIG. 2 shows a wired terminal protocol packet format that may be utilized to support a wireless terminal using the techniques of the invention.

FIG. 3 shows an illustrative embodiment of a wireless terminal configured in accordance with the invention.

FIG. 4 is a table illustrating symbol generation in an illustrative embodiment of the invention.

FIGS. 5A through 5G are tables illustrating field-based commands and associated parameters of the wireless terminal, after resizing of the command space associated with the wired terminal protocol.

Detailed Description of the Invention

The invention will be illustrated below in conjunction with an exemplary wireless communication system. Although particularly well-suited for use with, e.g., a telephone system which supports both wired deskset terminals and wireless terminals, the invention is not limited to use with any particular type of system or terminal. The disclosed techniques may be used in any communication application in which it is desirable to utilize a given terminal protocol to provide bandwidth-efficient support of a terminal which uses less than the full available command space of the terminal protocol. For example, the invention may be applied to handsets for use in cellular and personal communication services (PCS) systems, and to other types of communication terminals, such as wired ISDN terminals. The word "terminal" as used herein should therefore be understood to include not only portable wireless handsets as in the illustrative embodiment, but also other types of communication devices, including personal computers, wired and wireless desksets, optical communication terminals, or any terminal supported by a message-oriented command structure. It should be noted that the invention does not require any particular type of information transport medium, i.e., the invention may be implemented with any desired transport type. The term "switch" as used herein should be understood to include enterprise switches and other types of telecommunication switches, as well as other types of processor-based communication control devices such as servers, computers, adjuncts, etc. The term "table" as used herein is intended to include not only tabular representations as in the illustrative embodiments, but any other type and arrangement of data from which information can be extracted using one or more identifiers. For example, information stored in an addressable memory may be viewed as an example of one type of table.

FIG. 1 shows a portion of an exemplary communication system 100 in which the invention may be implemented. The system 100 includes an enterprise switch 110 which receives as an input a trunk 114. The trunk 114 supplies incoming calls to the switch 110 for processing. The switch 110 in this embodiment includes a central processing unit (CPU) 115, a memory 116, at least one interworking function (IWF) 117, and a system database 118. The CPU 115 may be a microprocessor, an application-specific integrated circuit (ASIC) or other type of digital data processor, as well as various portions or combination of such elements. The memory 116 may be

a random access memory (RAM), a read-only memory (ROM) or combinations of these and other types of electronic memory devices.

The IWF 117 is used to provide necessary format conversions pertaining to signaling and transport, in a known manner. The IWF 117 may in other embodiments be incorporated into other elements of switch 110, such as the CPU 115 and memory 116. The system database 118 may be used to store, e.g., feature assignments to particular feature buttons, directory number assignments to corresponding call appearances or direct facility termination keys, access restrictions, and other known administrative information regarding the configuration of the system 100, as well as other types of information.

The switch 110 in this example further includes four port cards 120A, 120B, 120C and 120D. Port card 120A is coupled to a wireless base station 121 which communicates with a first wireless terminal (WT) 122 designated WT1 and a second wireless terminal 123 designated WT2. The terminal WT1 may be a mobile telephone, and the terminal WT2 may be a wireless deskset. Port card 120B is connected to a broadband wireless base station, e.g., a National Information Infrastructure (NII) wireless base station 124, which communicates with a wireless personal computer (WPC) 125. Port card 120C is connected to a wired deskset (DS) 126. Port card 120D is connected to an advanced terminal (AT) 127, which may be, for example, a video telephone operating in accordance with the H.320 standard. It should be noted that the switch 110 may include additional port cards, and may be connected to other types and arrangements of user terminals. The switch 110 is also connected to an administrator terminal 128 which may be used to program the operation of the switch 110 during a system administration, e.g., an initial set-up and configuration of the system or a subsequent system-level or user-level reconfiguration.

The system 100 of FIG. 1 includes an adjunct feature server 129. The adjunct feature server 129 may be directly connected to the switch 110 or connected thereto over a network or other suitable transport medium. The adjunct feature server 129 may be used, e.g., to implement various aspects of a symbol-based control technique in accordance with the invention. Although shown as separate from the switch in the embodiment of FIG. 1, an adjunct such as adjunct feature server 129 is considered to fall within the general definition of the term "switch" as given previously. Such an adjunct may be physically incorporated within the switch in other embodiments of the invention, and

may be partially or completely implemented using other switch elements such as CPU 115 and memory 116.

The present invention in the illustrative embodiment allows an existing wired terminal protocol, such as a protocol used to control wired deskset terminal 126 in the system of FIG. 1, to be extended in a bandwidth-efficient manner to support wireless terminals, such as the mobile wireless terminal 122. More particularly, the invention allows the wireless terminal 122 to operate using an existing wired terminal protocol of system 100 but at a substantially reduced bandwidth consumption and with a high degree of optimization for the specific characteristics of the wireless terminal. A typical wired terminal protocol supports a large number of commands, e.g., for controlling a deskset or other type of multifunction business telephone. In the illustrative embodiment to be described below, a set of command symbols are created to replace the conventional multi-octet, field-based, bit-oriented command structure of the existing wired terminal protocol. A mechanism is defined for creating the command symbols, e.g., on the wireless port card in the serving switch, and for decoding and executing them in the served wireless terminal. Note that in the process, individual bits lose their assigned identity in the wired terminal protocol to that of the generated command symbol, and that overall bit utilization is reduced while performing equivalent command functions. The invention is illustrated herein by way of example using the downlink, i.e., switch-to-terminal, symbol generation procedure. The terminal-to-switch procedure can be implemented in a similar manner, as will be apparent to those skilled in the art.

FIG. 2 illustrates a standard wired terminal protocol which serves as the basis for the symbol generator in the illustrative embodiment. In accordance with the protocol, a given fixed-length 24-bit packet 130 includes a header field 132 and a command portion 134. The header field 132 contains four bits of control information, including a primary switchhook (PSH) state bit 135, a secondary switchhook (SSH) state bit 136 (bit B2), an extended protocol (XP) indicator bit 137, and a test bit (TST) 138. The PSH state bit 135 indicates the state of the wired terminal handset-related switchhook, the SSH state bit 136 indicates the state of the wired terminal intercom service, the XP indicator bit 137 is used to support datagrams via an adjunct interface of the wired terminal, and the TST bit 138 is used to indicate to the serving switch that the wired terminal has entered a user-commanded self-test mode. The command portion 134 in this embodiment contains a 4-bit

command pointer field 140, which indicates the type or category of command the terminal is to execute, two 4-bit command data segments 142-1 and 142-2 which specify the particular command within a given category, and an 8-bit cyclic redundancy code (CRC) field 144 to ensure command integrity. The command pointer 140 generally addresses a particular terminal element, and pointers
 5 are available for categories such as, e.g., audio path control, alerter control, user interface condition control, and display control.

FIG. 3 shows a wireless terminal 122 to which the above-described wired terminal protocol will be applied in the illustrative embodiment of the invention. The terminal 122 includes a housing 150 with a speaker 152, a microphone 154, a display 156 and an audio alerter 158. The display 156,
 10 which may be an LCD display or other suitable type of display, includes a display area 160, a set of local icons 162-1, 162-2 and 162-3, a system icon 164, and a set of SLK labels 170-1, 170-2, 170-3 and 170-4 which indicate the functions associated with SLKs K1, K2, K3 and K4, respectively. A given physical SLK can have multiple function assignments which vary in accordance with the feature labels, based on the symbol-based control techniques of the invention to be described in
 15 greater detail below.

The local icons 162-1, 162-2 and 162-3 indicate locally-generated status information associated with the wireless terminal, e.g., battery charge remaining, signal strength, etc. The system icon 164 conveys system information supplied to the terminal by the switch. Alternative embodiments could include multiple switch-driven system icons. The wireless terminal 122 further
 20 includes buttons P1, P2, P3 and P4, LED indicators 172-1, 172-2 and 172-3, and a conventional set of touch-tone dialpad buttons 174. It should be emphasized that the configuration of wireless terminal 122 as shown in FIG. 3 is for purposes of illustration only, and should not be construed as limiting the invention to any particular type of wireless terminal.

The command symbol generation procedure in the illustrative embodiment of the invention is as follows. First, the command space is resized according to the requirements of the wireless terminal user interface application, e.g., the wireless terminal of FIG. 3. This involves determining all command elements which are not of use to the button and indicator fields available on the wireless terminal 122. These fields are relatively small as compared to the more complex wired terminal for which the FIG. 2 protocol is designed. FIG. 4 shows a table illustrating the resizing
 25

process. Bits B1 and B2 in the FIG. 4 table correspond to the PSH bit 135 and TST bit 138, respectively, in the FIG. 2 packet format. Bits B3 and B4 correspond to the two bits of the command pointer 140. Bits B5 through B8 may correspond to one of the four-bit data segments 142-1 or 142-2. All entries in the FIG. 4 table that are not applicable to the function of the wireless terminal are shaded. For example, the maintenance test operation is not permitted when the wireless terminal is active in a call. Therefore, all command entries which have the wireless terminal both “off-hook” on the primary switchhook and in test mode are shaded. Similar command field reductions are made against other command space entries in the wired terminal protocol. Also, bits corresponding to functions which are irrelevant to the wireless terminal, e.g. the SSH bit 136 for an intercom function and the XP bit 137 for a datagram service, are eliminated from the wireless terminal command space, and are thus not shown in the FIG. 4 table.

FIGS. 5A through 5G show tables illustrating the resulting field-based commands and associated parameters of the wireless terminal, after the above-described resizing of the command space. FIGS. 5A and 5B show the interpretation of bits B1 and B2, respectively, which as previously noted correspond to the PSH and TST bits, respectively. FIG. 5C shows the interpretation of the pointer bits B3 and B4. These bits specify a particular command category in the wireless terminal, and include visual indicator, audio alerter, display predetermined string, and display data string command categories. FIGS. 5D through 5G illustrate the specific commands for each of these command categories.

FIG. 5D shows that the visual indicator includes a two-bit indicator ID, one for each of the system icon 164 and the three LEDs 172-1, 172-2 and 172-3. For the system icon 164, the available attributes are on, off, and reverse video. For the LEDs, the available attributes are on, off, flash and fast blink. FIG. 5E shows that the audio alerter 158 supports eight patterns: no alert, alert patterns 1 to 5, call waiting alert, and test alert pattern for maintenance. When the wireless terminal is active in a call, the audio alerter 158 can have only two patterns: no alert, or call waiting alert. FIG. 5F indicates that the pre-determined display string commands include eight system-defined display strings, and three supplementary display commands: clear display, load display string, and display test pattern. When the system initiates the test operation at the wireless terminal, the audio alerter has a dedicated alerting pattern for test, and the display has the display test string. The system will

not send the display data to the display during the test operation. With regard to the predetermined string display functions of FIG. 5F, system-defined display strings can be downloaded to the wireless terminal via the “load string” command as follows:

```

load string
string N
string character 1 (upper 4-bit)
string character 1 (lower 4-bit)
string character 2 and so on.
string character NULL
string character NULL (as terminator)

```

The data string display functions of FIG. 5G may be used to display multiple characters, e.g., a telephone number, on the display of the wireless terminal. A telephone number may thus be supplied from the system to the wireless terminal for display.

The tables of FIGS. 5A through 5G represent the essential and sufficient functions required to control the wireless terminal 122 of FIG. 3 using the wired terminal protocol of FIG. 2. These tabulations demonstrate the sufficiency of the reduced command set, and the command points available to drive the wireless terminal in a fashion substantially equivalent to, e.g., that with which the system users are familiar based on their wired terminals. As shown in FIG. 4, the applicable combinations of commands for this wireless terminal can be reduced to a total of only 103 combinations, each corresponding to a unique symbol.

In the next step of the symbol generation process, the reduced command field is cross-coded, as illustrated in the diagram of FIG. 4. In the illustrative embodiment, bits B5-B8 are orthogonalized against the balance of the frame structure, i.e., bits B1-B4. Particular values of bits B5-B8 are assigned to rows of the FIG. 4 table, and particular values of bits B1-B4 to columns as shown. Other orthogonalization arrangements may also be used, and yield similar results. As the final step in the symbol generation process, command symbol values are assigned, in this case serially and sequentially, to the valid, i.e., non-shaded, entries in the table of FIG. 4. In other words, symbol numbers are assigned starting with the valid entry in the right-most and upper-most position in the table, and subsequent valid entries are numbered serially and sequentially, i.e., in order continuing

down the first column, then from the upper-most valid entry in the next column down that column, and so on. This results in 103 assigned symbols, labeled as shown in FIG. 4. Other techniques may be used to assign symbol numbers to valid entries in the command space, including random assignment techniques.

5 Note that the command space in this illustrative embodiment has been reduced from a 24 bit structure, with 2^{24} symbol possibilities, to one which can be represented using less than 2^7 symbols, and thus only 7 bits. As is apparent from FIG. 4, each of the symbols corresponds to a particular entry in the table, and thus a particular combination of commands. In general, the total number of valid entries in the reduced command space is less than or equal to 2^N , where N is the number of bits
10 in a given symbol. A parity bit may be added in the illustrative embodiment as an additional integrity check, and to preserve an octet-based format, which is assumed by most commercially available hardware components. The eighth bit in the illustrative embodiment may alternatively be used to expand the symbol count if mandated by system requirements. The need for an integrity check generally depends on the particular medium used in a given application. For example, in the
15 wireless domain, primary integrity checks may be executed by the Media Access Control (MAC) function, such that the CRC is not needed. Other applications could utilize a shortened CRC or other type of integrity check.

The symbol generation process in the illustrative embodiment may be implemented in whole or in part in a port card in the serving switch, e.g., in port card 120A associated with wireless base
20 station 121 in system 100 of FIG. 1, elsewhere in the enterprise switch 110, e.g., using CPU 115 and memory 116, in the wireless terminal 122, in the adjunct feature server 129, or in various combinations of these and other system elements. Other suitable arrangements of hardware and/or software may be used to implement the symbol generation process in accordance with the invention. The wireless terminal 122 includes suitable circuitry for receiving symbols, decoding a given
25 received symbol, and executing the corresponding combination of commands uniquely specified by that symbol. Such receiving, decoding and execution circuitry may include, e.g., a conventional processor and memory, and may be implemented in a straightforward manner.

The above-described illustrative embodiment of the invention significantly reduces the command field associated with supporting the operation of a wireless terminal using an existing

wired terminal protocol. This results in a proportional bandwidth consumption reduction when communicating over wireless communication channels, thereby preserving this scarce resource. The full functionality of the system, as expressed by the wired terminal protocol, is made available to the wireless terminal, to the extent implementable in that terminal. In addition, there is no need to subject the command symbols to bitwise encryption, since their field mapping conventions in accordance with the wired terminal protocol are eliminated during the symbol generation process of the invention. As previously noted, the above-described embodiment of the invention is intended to be illustrative only. For example, the invention is not restricted to use in applications in which a wired terminal protocol is supported by a wireless terminal, as in the illustrative embodiment, but is instead more broadly applicable to any application in which an existing terminal protocol is used to support a terminal which utilizes less than the full available command space of the terminal protocol. In addition, although illustrated for downlink, i.e., switch-to-terminal communication, the invention can also be used for uplink, i.e., terminal-to-switch, communications. These and numerous other alternative embodiments within the scope of the following claims will be apparent to those skilled in the art.

Claims

What is claimed is:

1. A method of controlling a terminal in a communication system, the method comprising the steps of:

5 generating a command symbol representative of a plurality of commands in accordance with a terminal protocol supported by a switch of the system; and

 transmitting the command symbol to a terminal having a valid command space which is less than a full command space of the terminal protocol, wherein the terminal decodes the symbol and executes the corresponding plurality of commands.

10 2. The method of claim 1 wherein the terminal protocol is a wired terminal protocol, and the terminal is a wireless terminal.

15 3. The method of claim 2 further including the steps of:
 resizing a command space associated with the wired terminal protocol to generate a reduced command space suitable for use with the wireless terminal;

 generating a representation in which a first portion of the reduced command space is correlated with a second portion of the reduced command space; and

20 assigning command symbols to valid entries in the representation, such that a given one of the command symbols uniquely identifies a particular set of commands in the reduced command space.

 4. The method of claim 2 wherein the wired terminal protocol utilizes a field-based fixed-length packet format including a header portion and a command portion.

25 5. The method of claim 4 wherein the header portion includes at least one of a primary switchhook indicator, a secondary switchhook indicator, an extended protocol indicator and a test indicator.

6. The method of claim 4 wherein the command portion includes a command pointer identifying a category of commands and at least one command data segment identifying a particular command in a given one of the categories of commands.

5 7. The method of claim 5 wherein a given one of the command symbols specifies commands associated with at least the primary switchhook and the test indicator.

8. The method of claim 6 wherein a given one of the command symbols specifies commands associated with at least a portion of the command pointer and the command data segment.

10 9. The method of claim 3 wherein the step of generating a representation includes forming a tabular representation in which specific values of bits in the first portion of the reduced command space correspond to columns, and in which specific values of bits in the second portion of the reduced command space correspond to rows.

15 10. The method of claim 9 wherein the bits in the first portion of the reduced command space include at least one bit for each of a primary switchhook, a test indicator, and a command pointer.

20 11. The method of claim 9 wherein the bits in the second portion of the reduced command space include a plurality of command data segment bits.

12. An apparatus for controlling a terminal in a communication system, comprising:
a memory, associated with a switch of the system, for storing a set of command
25 symbols, wherein each of at least a subset of the command symbols is representative of a plurality of commands in accordance with a terminal protocol supported by the switch; and
a processor coupled to the memory and operative to direct the transmission of a particular one of the command symbols to a terminal having a valid command space which is less

than a full command space of the terminal protocol, wherein the terminal decodes the symbol and executes the corresponding plurality of commands.

13. The apparatus of claim 12 wherein the terminal protocol is a wired terminal protocol,
5 and the terminal is a wireless terminal.

14. The apparatus of claim 13 wherein the set of command symbols is generated by resizing
a command space associated with the wired terminal protocol to generate a reduced command space
suitable for use with the wireless terminal, generating a representation in which a first portion of the
10 reduced command space is correlated with a second portion of the reduced command space, and
assigning command symbols to valid entries in the representation, such that a given one of the
command symbols uniquely identifies a particular set of commands in the reduced command space.

15. The apparatus of claim 13 wherein the wired terminal protocol utilizes a field-based
15 fixed-length packet format including a header portion and a command portion.

16. The apparatus of claim 15 wherein the header portion includes at least one of a primary
switchhook indicator, a secondary switchhook indicator, an extended protocol indicator and a test
indicator.

17. The apparatus of claim 15 wherein the command portion includes a command pointer
identifying a category of commands and at least one command data segment identifying a particular
command in a given one of the categories of commands.

18. The apparatus of claim 16 wherein a given one of the command symbols specifies
25 commands associated with at least the primary switchhook and the test indicator.

19. The apparatus of claim 17 wherein a given one of the command symbols specifies
commands associated with at least a portion of the command pointer and the command data segment.

20. The apparatus of claim 14 wherein the representation comprises a tabular representation in which specific values of bits in the first portion of the reduced command space correspond to columns, and in which specific values of bits in the second portion of the reduced command space corresponding to rows.

21. The apparatus of claim 20 wherein the bits in the first portion of the reduced command space include at least one bit for each of a primary switchhook, a test indicator, and a command pointer.

22. The apparatus of claim 20 wherein the bits in the second portion of the reduced command space include a plurality of command data segment bits.

23. The apparatus of claim 13 wherein the processor comprises a central processing unit of the switch.

24. The apparatus of claim 13 wherein at least one of the memory and the processor are associated with a port card in the switch of the system.

25. An apparatus comprising:
a system terminal operative to receive command symbols from a system switch, each of at least a subset of the command symbols being representative of a plurality of commands in accordance with a terminal protocol supported by the switch, wherein the terminal has a valid command space which is less than a full command space of the terminal protocol, and wherein the terminal decodes a given one of the symbols and executes the corresponding plurality of commands.

26. An article of manufacture comprising:
a machine-readable storage medium storing one or more programs for implementing a method of controlling a terminal in a communication system, wherein the one or more programs when executed generate command symbols, each of at least a subset of the command symbols

representative of a plurality of commands in accordance with a terminal protocol supported by a switch of the system, such that a given one of the symbols, when transmitted to a terminal having a valid command space which is less than a full command space of the terminal protocol, directs the terminal to execute the corresponding plurality of commands.

11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60
61
62
63
64
65
66
67
68
69
70
71
72
73
74
75
76
77
78
79
80
81
82
83
84
85
86
87
88
89
90
91
92
93
94
95
96
97
98
99
100
101
102
103
104
105
106
107
108
109
110
111
112
113
114
115
116
117
118
119
120
121
122
123
124
125
126
127
128
129
130
131
132
133
134
135
136
137
138
139
140
141
142
143
144
145
146
147
148
149
150
151
152
153
154
155
156
157
158
159
160
161
162
163
164
165
166
167
168
169
170
171
172
173
174
175
176
177
178
179
180
181
182
183
184
185
186
187
188
189
190
191
192
193
194
195
196
197
198
199
200
201
202
203
204
205
206
207
208
209
210
211
212
213
214
215
216
217
218
219
220
221
222
223
224
225
226
227
228
229
230
231
232
233
234
235
236
237
238
239
240
241
242
243
244
245
246
247
248
249
250
251
252
253
254
255
256
257
258
259
260
261
262
263
264
265
266
267
268
269
270
271
272
273
274
275
276
277
278
279
280
281
282
283
284
285
286
287
288
289
290
291
292
293
294
295
296
297
298
299
300
301
302
303
304
305
306
307
308
309
310
311
312
313
314
315
316
317
318
319
320
321
322
323
324
325
326
327
328
329
330
331
332
333
334
335
336
337
338
339
340
341
342
343
344
345
346
347
348
349
350
351
352
353
354
355
356
357
358
359
360
361
362
363
364
365
366
367
368
369
370
371
372
373
374
375
376
377
378
379
380
381
382
383
384
385
386
387
388
389
390
391
392
393
394
395
396
397
398
399
400
401
402
403
404
405
406
407
408
409
410
411
412
413
414
415
416
417
418
419
420
421
422
423
424
425
426
427
428
429
430
431
432
433
434
435
436
437
438
439
440
441
442
443
444
445
446
447
448
449
450
451
452
453
454
455
456
457
458
459
460
461
462
463
464
465
466
467
468
469
470
471
472
473
474
475
476
477
478
479
480
481
482
483
484
485
486
487
488
489
490
491
492
493
494
495
496
497
498
499
500
501
502
503
504
505
506
507
508
509
510
511
512
513
514
515
516
517
518
519
520
521
522
523
524
525
526
527
528
529
530
531
532
533
534
535
536
537
538
539
540
541
542
543
544
545
546
547
548
549
550
551
552
553
554
555
556
557
558
559
560
561
562
563
564
565
566
567
568
569
570
571
572
573
574
575
576
577
578
579
580
581
582
583
584
585
586
587
588
589
590
591
592
593
594
595
596
597
598
599
600
601
602
603
604
605
606
607
608
609
610
611
612
613
614
615
616
617
618
619
620
621
622
623
624
625
626
627
628
629
630
631
632
633
634
635
636
637
638
639
640
641
642
643
644
645
646
647
648
649
650
651
652
653
654
655
656
657
658
659
660
661
662
663
664
665
666
667
668
669
670
671
672
673
674
675
676
677
678
679
680
681
682
683
684
685
686
687
688
689
690
691
692
693
694
695
696
697
698
699
700
701
702
703
704
705
706
707
708
709
710
711
712
713
714
715
716
717
718
719
720
721
722
723
724
725
726
727
728
729
730
731
732
733
734
735
736
737
738
739
740
741
742
743
744
745
746
747
748
749
750
751
752
753
754
755
756
757
758
759
760
761
762
763
764
765
766
767
768
769
770
771
772
773
774
775
776
777
778
779
780
781
782
783
784
785
786
787
788
789
790
791
792
793
794
795
796
797
798
799
800
801
802
803
804
805
806
807
808
809
810
811
812
813
814
815
816
817
818
819
820
821
822
823
824
825
826
827
828
829
830
831
832
833
834
835
836
837
838
839
840
841
842
843
844
845
846
847
848
849
850
851
852
853
854
855
856
857
858
859
860
861
862
863
864
865
866
867
868
869
870
871
872
873
874
875
876
877
878
879
880
881
882
883
884
885
886
887
888
889
890
891
892
893
894
895
896
897
898
899
900
901
902
903
904
905
906
907
908
909
910
911
912
913
914
915
916
917
918
919
920
921
922
923
924
925
926
927
928
929
930
931
932
933
934
935
936
937
938
939
940
941
942
943
944
945
946
947
948
949
950
951
952
953
954
955
956
957
958
959
960
961
962
963
964
965
966
967
968
969
970
971
972
973
974
975
976
977
978
979
980
981
982
983
984
985
986
987
988
989
990
991
992
993
994
995
996
997
998
999
1000
1001
1002
1003
1004
1005
1006
1007
1008
1009
1010
1011
1012
1013
1014
1015
1016
1017
1018
1019
1020
1021
1022
1023
1024
1025
1026
1027
1028
1029
1030
1031
1032
1033
1034
1035
1036
1037
1038
1039
1040
1041
1042
1043
1044
1045
1046
1047
1048
1049
1050
1051
1052
1053
1054
1055
1056
1057
1058
1059
1060
1061
1062
1063
1064
1065
1066
1067
1068
1069
1070
1071
1072
1073
1074
1075
1076
1077
1078
1079
1080
1081
1082
1083
1084
1085
1086
1087
1088
1089
1090
1091
1092
1093
1094
1095
1096
1097
1098
1099
1100
1101
1102
1103
1104
1105
1106
1107
1108
1109
1110
1111
1112
1113
1114
1115
1116
1117
1118
1119
1120
1121
1122
1123
1124
1125
1126
1127
1128
1129
1130
1131
1132
1133
1134
1135
1136
1137
1138
1139
1140
1141
1142
1143
1144
1145
1146
1147
1148
1149
1150
1151
1152
1153
1154
1155
1156
1157
1158
1159
1160
1161
1162
1163
1164
1165
1166
1167
1168
1169
1170
1171
1172
1173
1174
1175
1176
1177
1178
1179
1180
1181
1182
1183
1184
1185
1186
1187
1188
1189
1190
1191
1192
1193
1194
1195
1196
1197
1198
1199
1200
1201
1202
1203
1204
1205
1206
1207
1208
1209
1210
1211
1212
1213
1214
1215
1216
1217
1218
1219
1220
1221
1222
1223
1224
1225
1226
1227
1228
1229
1230
1231
1232
1233
1234
1235
1236
1237
1238
1239
1240
1241
1242
1243
1244
1245
1246
1247
1248
1249
1250
1251
1252
1253
1254
1255
1256
1257
1258
1259
1260
1261
1262
1263
1264
1265
1266
1267
1268
1269
1270
1271
1272
1273
1274
1275
1276
1277
1278
1279
1280
1281
1282
1283
1284
1285
1286
1287
1288
1289
1290
1291
1292
1293
1294
1295
1296
1297
1298
1299
1300
1301
1302
1303
1304
1305
1306
1307
1308
1309
1310
1311
1312
1313
1314
1315
1316
1317
1318
1319
1320
1321
1322
1323
1324
1325
1326
1327
1328
1329
1330
1331
1332
1333
1334
1335
1336
1337
1338
1339
1340
1341
1342
1343
1344
1345
1346
1347
1348
1349
1350
1351
1352
1353
1354
1355
1356
1357
1358
1359
1360
1361
1362
1363
1364
1365
1366
1367
1368
1369
1370
1371
1372
1373
1374
1375
1376
1377
1378
1379
1380
1381
1382
1383
1384
1385
1386
1387
1388
1389
1390
1391
1392
1393
1394
1395
1396
1397
1398
1399
1400
1401
1402
1403
1404
1405
1406
1407
1408
1409
1410
1411
1412
1413
1414
1415
1416
1417
1418
1419
1420
1421
1422
1423
1424
1425
1426
1427
1428
1429
1430
1431
1432
1433
1434
1435
1436
1437
1438
1439
1440
1441
1442
1443
1444
1445
1446
1447
1448
1449
1450
1451
1452
1453
1454
1455
1456
1457
1458
1459
1460
1461
1462
1463
1464
1465
1466
1467
1468
1469
1470
1471
1472
1473
1474
1475
1476
1477
1478
1479
1480
1481
1482
1483
1484
1485
1486
1487
1488
1489
1490
1491
1492
1493
1494
1495
1496
1497
1498
1499
1500
1501
1502
1503
1504
1505
1506
1507
1508
1509
1510
1511
1512
1513
1514
1515
1516
1517
1518
1519
1520
1521
1522
1523
1524
1525
1526
1527
1528
1529
1530
1531
1532
1533
1534
1535
1536
1537
1538
1539
1540
1541
1542
1543
1544
1545
1546
1547
1548
1549
1550
1551
1552
1553
1554
1555
1556
1557
1558
1559
1560
1561
1562
1563
1564
1565
1566
1567
1568
1569
1570
1571
1572
1573
1574
1575
1576
1577
1578
1579
1580
1581
1582
1583
1584
1585
1586
1587
1588
1589
1590
1591
1592
1593
1594
1595
1596
1597
1598
1599
1600
1601
1602
1603
1604
1605
1606
1607
1608
1609
1610
1611
1612
1613
1614
1615
1616
1617
1618
1619
1620
1621
1622
1623
1624
1625
1626
1627
1628
1629
1630
1631
1632
1633
1634
1635
1636
1637
1638
1639
1640
1641
1642
1643
1644
1645
1646
1647
1648
1649
1650
1651
1652
1653
1654
1655
1656
1657
1658
1659
1660
1661
1662
1663
1664
1665
1666
1667
1668
1669
1670
1671
1672
1673
1674
1675
1676
1677
1678
1679
1680
1681
1682
1683
1684
1685
1686
1687
1688
1689
1690
1691
1692
1693
1694
1695
1696
1697
1698
1699
1700
1701
1702
1703
1704
1705
1706
1707
1708
1709
1710
1711
1712
1713
1714
1715
1716
1717
1718
1719
1720
1721
1722
1723
1724
1725
1726
1727
1728
1729
1730
1731
1732
1733
1734
1735
1736
1737
1738
1739
1740
1741
1742
1743
1744
1745
1746
1747
1748
1749
1750
1751
1752
1753
1754
1755
1756
1757
1758
1759
1760
1761
1762
1763
1764
1765
1766
1767
1768
1769
1770
1771
1772
1773
1774
1775
1776
1777
1778
1779
1780
1781
1782
1783
1784
1785
1786
1787
1788
1789
1790
1791
1792
1793
1794
1795
1796
1797
1798
1799
1800
1801
1802
1803
1804
1805
1806
1807
1808
1809
1810
1811
1812
1813
1814
1815
1816
1817
1818
1819
1820
1821
1822
1823
1824
1825
1826
1827
1828
1829
1830
1831
1832
1833
1834
1835
1836
1837
1838
1839
1840
1841
1842
1843
1844
1845
1846
1847
1848
1849
1850
1851
1852
1853
1854
1855
1856
1857
1858
1859
1860
1861
1862
1863
1864
1865
1866
1867
1868
1869
1870
1871
1872
1873
1874
1875
1876
1877
1878
1879
1880
1881
1882
1883
1884
1885
1886
1887
1888
1889
1890
1891
1892
1893
1894
1895
1896
1897
1898
1899
1900
1901
1902
1903
1904
1905
1906
1907
1908
1909
1910
1911
1912
1913
1914
1915
1916
1917
1918
1919
1920
1921
1922
1923
1924
1925
1926
1927
1928
1929
1930
1931
1932
1933
1934
1935
1936
1937
1938
1939
1940
1941
1942
1943
1944
1945
1946
1947
1948
1949
1950
1951
1952
1953
1954
1955
1956
1957
1958
1959
1960
1961
1962
1963
1964
1965
1966
1967
1968
1969
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035
2036
2037
2038
2039
2040
2041
2042
2043
2044
2045
2046
2047
2048
2049
2050
2051
2052
2053
2054
2055
2056
2057
2058
2059
2060
2061
2062
2063
2064
2065
2066
2067
2068
2069
2070
2071
2072
2073
2074
2075
2076
2077
2078
2079
2080
2081
2082
2083
2084
2085
2086
2087
2088
2089
2090
2091
2092
2093
2094
2095
2096
2097
2098
2099
2100
2101
2102
2103
2104
2105
2106
2107
2108
2109
2110
2111
2112
2113
2114
2115
2116
2117
2118
2119
2120
2121
2122
2123
2124
2125
2126
2127
2128
2129
2130
2131
2132
2133
2134
2135
2136
2137
2138
2139
2140
2141
2142
2143
2144
2145
2146
2147
2148
2149
2150
2151
2152
2153
2154
2155
2156
2157
2158
2159
2160
2161
2162
2163
2164
2165
2166
2167
2168
2169
2170
2171
2172
2173
2174
2175
2176
2177
2178
2179
2180
2181
2182
2183
2184
2185
2186
2187
2188
2189
2190
2191
2192
2193
2194
2195
2196
2197
2198
2199
2200
2201
2202
2203
2204
2205
2206
2207
2208
2209
2210
2211
2212
2213
2214
2215
2216
2217
2218
2219
2220
2221
2222
2223
2224
2225
2226
2227
22

Abstract

A wireless terminal or other type of terminal in a communication system is controlled in a bandwidth-efficient manner using commands associated with a terminal protocol supported by a switch of the system. In an illustrative embodiment, a set of command symbols are generated by:

5 (i) resizing a command space associated with a wired terminal protocol to obtain a reduced command space suitable for use with a wireless terminal; (ii) generating a representation in which a first portion of the reduced command space is correlated with a second portion of the reduced command space; and (iii) assigning command symbols to valid entries in the representation, such that a given one of the command symbols uniquely identifies a particular combination of commands in the reduced command space. The switch transmits a given command symbol to the wireless terminal, and the wireless terminal decodes the symbol and executes the corresponding commands specified by the symbol. Since the command symbols can be represented using significantly fewer bits than would otherwise be required using the complete wired terminal protocol, the invention allows the switch to control the wireless terminal in a bandwidth-efficient manner, while still providing substantially the full functionality of the wired terminal protocol at the wireless terminal.

1200-238.APP

1/4

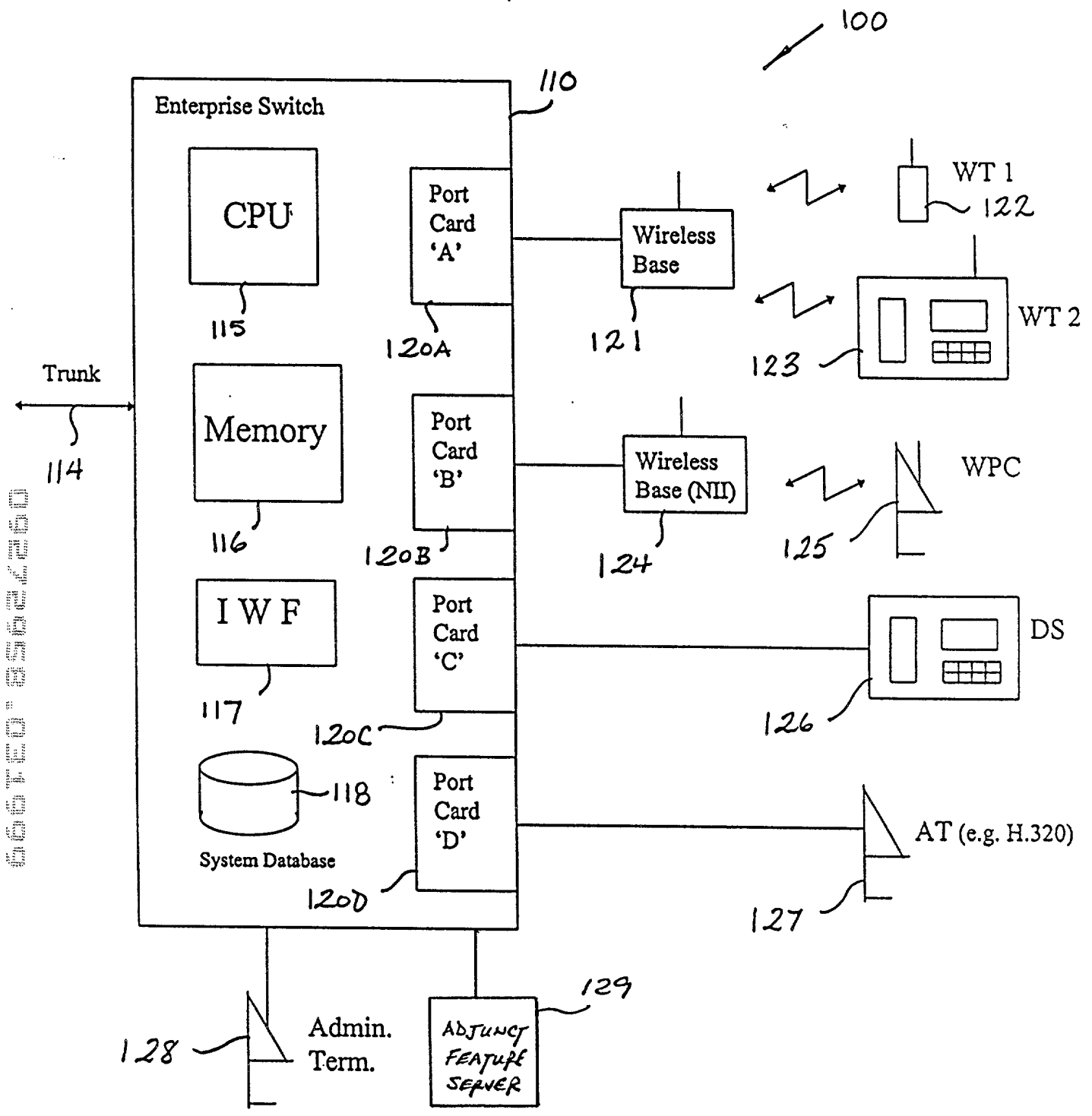


FIG. 1

130

132

134

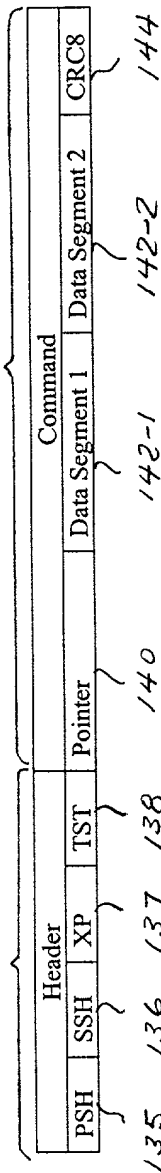


FIG. 2

2/4

VALUES (B5:B8)	OFF HOOK (B1 = 0)										ON HOOK (B1 = 1)									
	TEST OFF (B2 = 0)					TEST ON (B2 = 1)					TEST OFF (B2 = 0)					TEST ON (B2 = 1)				
	CATEGORY (B3 : B4)					CATEGORY (B3 : B4)					CATEGORY (B3 : B4)					CATEGORY (B3 : B4)				
0000	00	01	10	11	11	00	01	10	11	11	00	01	10	11	11	00	01	10	11	11
0001	1	16	18	29	29	41	56	64	75	75	41	56	64	75	75	41	56	64	75	75
0010	2	19	30	30	30	42	57	65	76	76	42	57	65	76	76	42	57	65	76	76
0011	3	20	31	31	31	43	58	66	77	77	43	58	66	77	77	43	58	66	77	77
0100	4	21	32	32	32	44	60	68	79	79	44	60	68	79	79	44	60	68	79	79
0101	5	22	33	33	33	45	61	69	80	80	45	61	69	80	80	45	61	69	80	80
0110	6	23	34	34	34	46	62	70	81	81	46	62	70	81	81	46	62	70	81	81
0111	7	24	35	35	35	47	63	71	82	82	47	63	71	82	82	47	63	71	82	82
1000	8	25	36	36	36	48	64	72	83	83	48	64	72	83	83	48	64	72	83	83
1001	9	26	37	37	37	49	65	73	84	84	49	65	73	84	84	49	65	73	84	84
1010	10	27	38	38	38	50	66	74	85	85	50	66	74	85	85	50	66	74	85	85
1011	11	28	39	39	39	51	67	75	86	86	51	67	75	86	86	51	67	75	86	86
1100	12	29	40	40	40	52	68	76	87	87	52	68	76	87	87	52	68	76	87	87
1101	13	30				53	69	77	88	88	53	69	77	88	88	53	69	77	88	88
1110	14	31				54	70	78	89	89	54	70	78	89	89	54	70	78	89	89
1111	15	32				55	71	79	90	90	55	71	79	90	90	55	71	79	90	90

FIG. 4

3/4

122

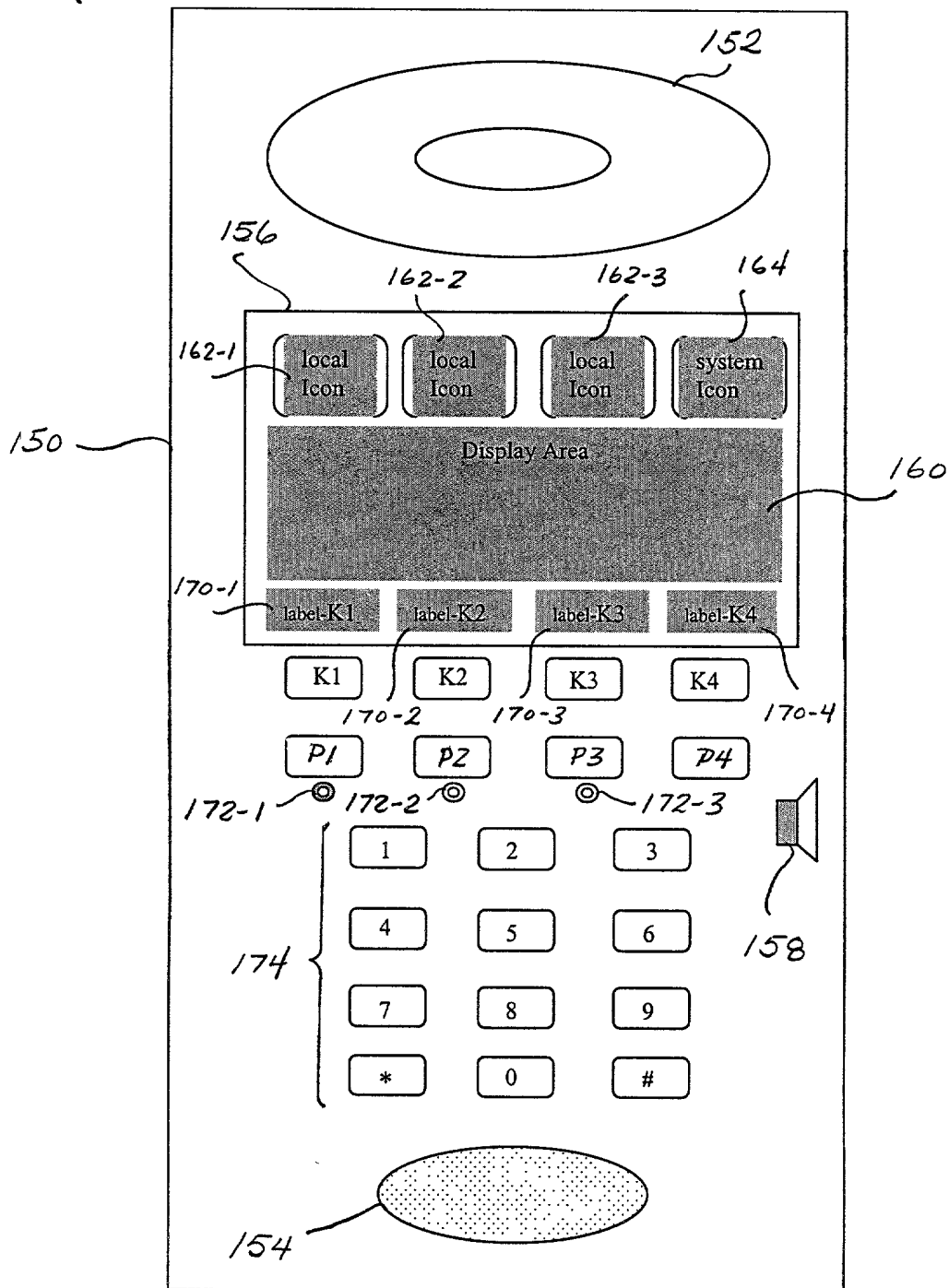


FIG. 3

FIG. 5A

B1: PSH, Primary switch hook state

B	primary switch hook state
1	on
0	off

FIG. 5B

B2: TST, Test operation

B	test operation
1	on
0	off

FIG. 5C

B3-B4: Pointer, category of application

B	3	B	4	application
0	0	0	0	visual indicator
0	0	1	0	audio alert
1	0	0	0	display pre-determined string
1	1	0	0	display data string

B5-B8: Visual Indicator

B	5	B	6	Indicator ID
0	0	0	0	ICON
0	1	0	0	LED 1
1	0	1	0	LED 2
1	1	1	0	LED 3

B5-B8: Attributes

B	7	B	8	Attributes
0	0	0	0	off (LED & ICON)
0	1	0	0	on (LED & ICON)
1	0	0	0	reverse video (ICON) flash (LED)
1	1	0	0	fast blink (LED)

FIG. 5D

FIG. 5E

B5 - B8: Display Pre-determined String

B	5	B	6	B	7	B	8	pre-determined display string
0	0	0	0	0	0	0	0	clear display
0	0	0	0	1	0	0	0	display string 1
0	0	0	1	0	0	0	0	display string 2
0	0	1	0	0	0	0	0	display string 3
0	1	0	0	0	0	0	0	display string 4
0	1	0	1	0	0	0	0	display string 5
0	1	1	0	0	0	0	0	display string 6
0	1	1	1	0	0	0	0	display string 7
1	0	0	0	0	0	0	0	display string 8
1	0	0	1	0	0	0	0	load display string
1	0	1	0	0	0	0	0	display test string
1	1	0	0	0	0	0	0	not used
1	1	0	1	0	0	0	0	not used
1	1	1	0	0	0	0	0	not used
1	1	1	1	0	0	0	0	not used

FIG. 5F

B5-B8: Display data string

B	5	B	6	B	7	B	8	display character
0	0	0	0	0	0	0	0	(reserved)
0	0	0	0	1	0	0	0	character 1
0	0	0	1	0	0	0	0	character 2
0	0	1	0	0	0	0	0	character 3
0	1	0	0	0	0	0	0	character 4
0	1	0	1	0	0	0	0	character 5
0	1	1	0	0	0	0	0	character 6
0	1	1	1	0	0	0	0	character 7
1	0	0	0	0	0	0	0	character 8
1	0	0	1	0	0	0	0	character 9
1	0	1	0	0	0	0	0	character 0
1	0	1	1	0	0	0	0	(space)
1	1	0	0	0	0	0	0	not used
1	1	0	1	0	0	0	0	not used
1	1	1	0	0	0	0	0	not used
1	1	1	1	0	0	0	0	not used

FIG. 5G

IN THE UNITED STATES
PATENT AND TRADEMARK OFFICE

Declaration and Power of Attorney

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name.

I believe I am an original, first and joint inventor of the subject matter which is claimed and for which a patent is sought on the invention entitled **SYMBOL-BASED CONTROL OF TERMINAL ENDPOINTS IN A COMMUNICATION SYSTEM** the specification of which is attached hereto.

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by an amendment, if any, specifically referred to in this oath or declaration.

I acknowledge the duty to disclose all information known to me which is material to patentability as defined in Title 37, Code of Federal Regulations, 1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, 119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

None

I hereby claim the benefit under Title 35, United States Code, 120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, 112, I acknowledge the duty to disclose all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, 1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application:

None

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

656760 "8964,650

I hereby appoint the following attorneys with full power of substitution and revocation, to prosecute said application, to make alterations and amendments therein, to receive the patent, and to transact all business in the Patent and Trademark Office connected therewith:

Lester H. Birnbaum	(Reg. No. 25830)
Richard J. Botos	(Reg. No. 32016)
Jeffery J. Brosemer	(Reg. No. 36096)
Kenneth M. Brown	(Reg. No. 37590)
Donald P. Dinella	(Reg. No. 39961)
Guy Eriksen	(Reg. No. 41736)
Martin I. Finston	(Reg. No. 31613)
James H. Fox	(Reg. No. 29379)
William S. Francos	(Reg. No. 38456)
Barry H. Freedman	(Reg. No. 26166)
Julio A. Garceran	(Reg. No. 37138)
Mony R. Ghose	(Reg. No. 38159)
Jimmy Goo	(Reg. No. 36528)
Anthony Grillo	(Reg. No. 36535)
Stephen M. Gurey	(Reg. No. 27336)
John M. Harman	(Reg. No. 38173)
John W. Hayes	(Reg. No. 33900)
Michael B. Johannesen	(Reg. No. 35557)
Mark A. Kurisko	(Reg. No. 38944)
Irena Lager	(Reg. No. 39260)
Christopher N. Malvone	(Reg. No. 34866)
Scott W. McLellan	(Reg. No. 30776)
Martin G. Meder	(Reg. No. 34674)
Geraldine Monteleone	(Reg. No. 40097)
John C. Moran	(Reg. No. 30782)
Michael A. Morra	(Reg. No. 28975)
Gregory J. Murgia	(Reg. No. 41209)
Claude R. Narcisse	(Reg. No. 38979)
Joseph J. Opalach	(Reg. No. 36229)
Neil R. Ormos	(Reg. No. 35309)
Eugen E. Pacher	(Reg. No. 29964)
Jack R. Penrod	(Reg. No. 31864)
Daniel J. Piotrowski	(Reg. No. 42079)
Gregory C. Ranieri	(Reg. No. 29695)
Scott J. Rittman	(Reg. No. 39010)
Eugene J. Rosenthal	(Reg. No. 36658)
Bruce S. Schneider	(Reg. No. 27949)
Ronald D. Slusky	(Reg. No. 26585)
David L. Smith	(Reg. No. 30592)
Patricia A. Verlangieri	(Reg. No. 42201)

669730-886460

Post Office Address: 4 Carla Court
Holmdel, New Jersey 07733

ATTACHMENT A

Attorney Name(s): Joseph B. Ryan Reg. No. 37922
Kevin M. Mason Reg. No. 36597
William E. Lewis Reg. No. 39274

Telephone calls should be made to Joseph B. Ryan of Ryan & Mason, L.L.P. at:

Phone No.: (516) 759-7517
Fax No.: (516) 759-9512

All written communications are to be addressed to:

Ryan & Mason, L.L.P.
90 Forest Avenue
Locust Valley, New York 11560

626160" 2524452